TI-31362   Patent Amendment

REMARKS

This application has been carefully reviewed in light of the Office Action dated January 25, 2005. Applicant has amended claims 1, 5 and 12. Reconsideration and favorable action in this case are respectfully requested.

The Examiner has rejected claims 1 and 5 under 35 U.S.C. §112. Applicants have corrected the claims as specified by the Examiner. Additionally, Applicants have amended claim 12 to provide proper antecedent basis.

The Examiner has rejected claims 1-14 under 35 U.S.C. §102(b) as being unpatentable over U.S. Pat. No. 5,828,568 to Sunakawa. Applicants have reviewed this reference in detail and do not believe that it discloses or makes obvious the invention as claimed.

The Examiner has rejected claim 15 under 35 U.S.C. §103(a) as being unpatentable over U.S. Pat. No. 6,718,164 to Korneluk et al in view of Sunakawa, cited above. Applicants have reviewed these references in detail and do not believe that they disclose or make obvious the invention as claimed.

The Sunakawa reference shows a system where multiple tasks are executed by a single processor. Some of the tasks may use a device external to the processor, such as an I/O device, during their operation. Instead of multitasking using equal, alternating time periods (see Fig. 5A, where tasks A, B and C are executed using interleaved execution periods), a task which uses one or more devices (external to the processor) with the largest power consumption is given higher priority in order to complete the task in a shorter period of time. By completing the high priority task in a shorter time period, power to the device (or devices) can be turned off earlier, thereby reducing the power consumed by the device (Abstract, column 8, line 42 through column 9, line 5). In a second embodiment (cited by the Examiner in the Office Action) initiating a device

pursuant to a task is delayed if turning on the device would exceed power limits (column 11, line 38 through column 12, line 9). In a third embodiment, increased power due to a device's transition from a high-power mode to a low-power mode is taken into consideration deciding upon whether to place the device in a low power mode once a task's access to a device is complete (column 13, line 48 through column 14, line 34). In a fourth embodiment, the hysteresis of intervals between accesses to the device is recorded (and averaged). This information is used in the determination of whether a device should transition to a low-power mode after the end of an access (column 17, line 60 through column 18, line 16). In a fifth embodiment, the transition of a hard disk drive is made with consideration of whether virtual memory is on or off (column 18, lines 17 - 37). In a sixth embodiment, a transition to a low power mode is made in consideration of a delay time associated with returning to a high power mode (column 18, lines 38-65).

The primary goal of Sunakawa is maximizing the time period in which devices external to the processor can be placed in a low power mode (or, in an alternative phrasing of the statement, minimizing the time that devices external to the processor are in a high-power mode). This is accomplished in Sunakawa by accelerating the completion of a task which uses the devices with the most power by delaying the execution of other tasks. This is shown in particular detail in Figures 5A and 5B. In Figure 5A, where tasks A, B and C are executed using equal, alternating processing cycles, I/O unit C is powered from time "0" to "t2" (t2 is equal to t1 - the time necessary to complete task C using equal alternating execution cycles – plus t_{idle} – the time for I/O unit C to power down after the start of a period of inactivity). In Figure 5B, task C is given two execution cycles for every execution cycle given to task A or task B; hence, task C completes at t3 (where t3 < t1). Accordingly, I/O unit C can power down by t4 (where t4 < t2). The second embodiment of Sunakawa, as cited by the Examiner, when a task makes an access to a device which is currently in a power-saving mode, the current consumption power of the circuit is detected to determine whether the device can be

TI-31362   Patent Amendment

started. If so, a timer determines the point at which the device is stabilized. If the device

can not be started due to power considerations, the task which made a request to access

the device is changed to a waiting state. When other devices are turned off, freeing up

power, the requested device is turned on.

The present invention, as defined by claim 1, has an entirely different goal – to

prevent hot spots which can cause failures in a processing circuit. In response to

detecting an excessive temperature at an area associated with a first processing module,

parameters for executing tasks on one or more *adjacent* processing modules are modified

to reduce the heat generated by the adjacent processing modules. The reduction of heat

generated by the adjacent modules affects the temperature at the module with the

excessive temperature.

Sunakawa does not teach the step of determining temperature-associated

information at various areas of a processing circuit. Determining which device uses the

most power (first embodiment of Sunakawa) or determining whether there is enough

power to turn on a requested device (second embodiment of Sunakawa) is entirely

different than determining temperature-associated information – for example, a first

processing module may consume more power than a second processing module, but

dissipate less heat if the power consumption is spread out over a larger area. Turning on

an additional device may be impossible due to available power constraints, without

causing temperature-related problems.

Second, Sunakawa does not teach modifying parameters for executing tasks on one

or more adjacent processing modules in order to reduce heat generated by the adjacent

processing modules in response to temperature-associated information indicating an

excessive temperature at an area associated with a first processing module. Nothing in

Sunakawa indicates or suggests that processing modules adjacent to the highest power

device (such as I/O unit C) are operated any differently when priority is given to a certain

TI-31362   Patent Amendment

task. The location of modules in Sunakawa is not discussed. Further, since Sunakawa modifies the execution of tasks based on a determination of the use of the highest power device, regardless of whether such use creates a temperature problem, it would diminish the operation of the circuit, with no temperature-related benefit, if the operation of other modules were modified on that basis alone.

In the second embodiment of Sunakawa, there is no determination of an excessive temperature within an area, only a determination that insufficient power exists for turning on an additional device. Further, there is no modification of parameters for executing tasks on one or more adjacent modules. The proximity of other modules is not even discussed in Sunakawa. Further, devices that are currently turned on in Sunakawa are simply allowed to continue under current parameters. When a device is turned off, the requested device is turned on.

Accordingly, Applicants respectfully request allowance of claim 1 and dependent claims 2-7.

For reasons set forth in connection with claim 1, Applicants respectfully request allowance of claim 8, along with dependent claims 9 – 11, and claim 15.

Claim 12 claims a processing circuit including a plurality of processing modules for executing multiple tasks and circuitry for generating a task allocation scenario for allocating the tasks among the processing modules, estimating temperature-associated information for various locations in the processing circuit and determining whether a temperature threshold would be exceeded if the tasks were to be executed according to the scenario.

As stated above, Sunakawa does not estimate temperature-associated information for various locations in the processing module and, hence, this information could not be used to determine whether a temperature threshold would be exceeded. To reiterate,

TI-31362   Patent Amendment

determining the power used by a device is not equivalent to determining whether a temperature threshold would be exceeded.
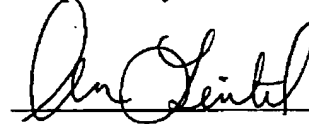
Accordingly, Applicants respectfully request allowance of claim 12 and dependent claims 13-14.

The Commissioner is hereby authorized to charge any fees or credit any overpayment, including extension fees, to Deposit Account No. 20-0668 of Texas Instruments Incorporated.

Applicants have made a diligent effort to place the claims in condition for allowance. However, should there remain unresolved issues that require adverse action, it is respectfully requested that the Examiner telephone Alan W. Lintel, Applicants' Attorney at (972) 664-9595 so that such issues may be resolved as expeditiously as possible.

For these reasons, and in view of the above amendments, this application is now considered to be in condition for allowance and such action is earnestly solicited.

Respectfully Submitted,

Alan W. Lintel
Attorney for Applicant(s)
Reg. No. 32478

March 25, 2005
Anderson, Levine & Lintel
14785 Preston Rd.
Suite 650
Dallas, Texas 75254
Tel. (972) 664-9595